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# The continuity of ocean color measurements from SeaWiFS to MODIS

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**ABSTRACT**

The Ocean Biology Processing Group (OBPG) at NASA's Goddard Space Flight Center is responsible for the processing and validation of oceanic optical property retrievals from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and the Moderate Resolution Imaging Spectroradiometer (MODIS). A major goal of this activity is the production of a continuous ocean color time-series spanning the mission life of these sensors from September 1997 to the present time. This paper presents an overview of the calibration and validation strategy employed to optimize and verify sensor performance for retrieval of upwelling radiances just above the sea surface. Substantial focus is given to the comparison of results over the common mission lifespan of SeaWiFS and the MODIS flying on the Aqua platform, covering the period from July 2002 through December 2004. It will be shown that, through consistent application of calibration and processing methodologies, a continuous ocean color time-series can be produced from two different spaceborne sensors.

Keywords: MODIS, SeaWiFS, ocean color, calibration, validation, data processing.

## 1. INTRODUCTION

Ocean color sensors are designed to retrieve the spectral distribution of upwelling radiance just above the sea surface, which is referred to as the water-leaving radiance or Lw(λ). The water-leaving radiance can be used to estimate a number of geophysical data parameters, such as the concentration of chlorophyll *a*, via the application of additional bio-optical algorithms (e.g., O'Reilly 1998). The Coastal Zone Color Scanner (CZCS), launched onboard the National Aeronautics and Space Administration (NASA) Nimbus-7 spacecraft, provided the first ocean color data set derived from a spaceborne sensor (Hovis 1980), and subsequently the first global view of the distribution of chlorophyll *a* (Feldman 1989). The success of CZCS prompted NASA to launch additional ocean color capable sensors into low earth orbit, including the Sea-viewing Wide Field-of-view Sensor (SeaWiFS, McClain 1998), and two Moderate Resolution Imaging Spectroradiometers (MODIS, Esaias 1998).

The SeaWiFS is a multi-spectral radiometer that has been in a sun-synchronous, 12:00 p.m. orbit since August 1997. SeaWiFS views the earth in eight spectral bands covering the visible and near-infrared (NIR) range from 400-900 nm. The MODIS instrument is currently flying on both the Aqua and Terra platforms of the Earth Observing System (EOS). The Terra platform was launched in December 1999 into a sun-synchronous 10:30 a.m. orbit, and the MODIS instrument on Terra (MODIS-Terra) has been in continuous operation since February 2000. The Aqua platform was launched in May 2002 into a sun-synchronous 1:30 p.m. orbit, and MODIS-Aqua has been in continuous operation since June 2002. The MODIS sensors measure radiance in 36 spectral channels covering the range from 400 nm to 14.4 μm, to support land, ocean, and atmospheric measurements. The bands of primary interest to ocean color applications are the 9 channels covering the spectral range from 400-900 nm. Both SeaWiFS and MODIS are scanning radiometers, collecting data over a wide swath with a pixel resolution of approximately 1-km x 1-km at the minimum view angle. The mission design allows for global observation of the top-of-atmosphere (TOA) radiance every two days. Unlike MODIS, the SeaWiFS mission was designed specifically for ocean color measurements, so it has some advantages such as the ability to tilt the optics to avoid specular reflection of the Sun on the ocean surface (glint).

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